

PROFESSIONAL MILITARY COMPTROLLER SCHOOL

## IDEA PAPER

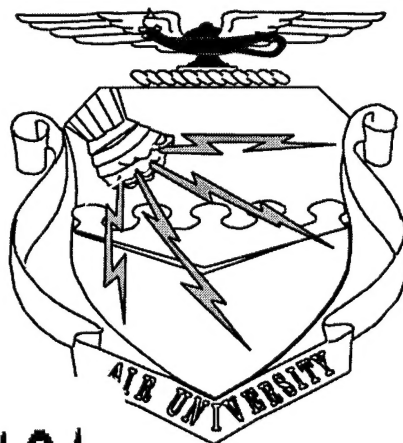
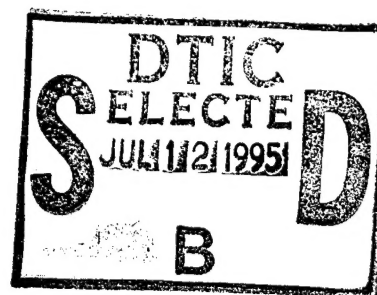
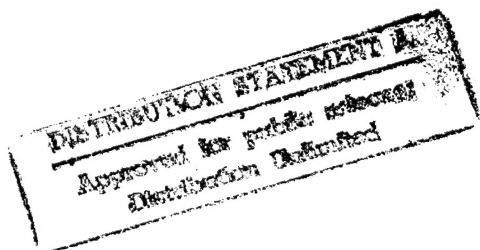
TITLE

**ESTIMATING DISPOSAL COSTS USING  
THE COMPONENT MATERIAL METHODOLOGY**

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## PMCS IDEA PAPER

**TITLE:** Estimating Disposal Costs Using the Component Material Methodology

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### EXECUTIVE SUMMARY

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The Office of Secretary of Defense (OSD) is modifying the 5000 series acquisition regulations to add a disposal and demilitarization phase to the acquisition life-cycle. As a result of these changes, program offices will be required to consider disposal costs in life-cycle cost estimates. Currently there is little data and few cost models for estimating disposal costs. The Component Material Estimating Methodology provides a working alternative for estimating weapon system disposal costs.

The Component Material Methodology (CMM) estimates disposal costs based on the type of materials used in a weapon system. The methodology looks at a system's individual components (e.g., engines, landing gear, and avionics), determines the type and quantity of materials used in each component (e.g., aluminum, heavy metals, and composites), and estimates the cost of disposing of those materials.

The Air Force Cost Analysis Agency, Navy Cost Center, and Army Center for Cost Analysis should use the CMM for estimating disposal costs if no applicable models are available. The CMM can be done with little "environmental" experience or knowledge. Using the CMM disposal estimates can be performed using a simple spreadsheet or a sophisticated cost model. The methodology is very flexible and can be used during any phase of the acquisition life-cycle.

## TABLE OF CONTENTS

INTRODUCTION.....	1
DISCUSSION.....	2
METHODOLOGY CONCEPT.....	2
METHODOLOGY EXPLANATION.....	2
Step-1: Break Down Weapon System by WBS.....	3
Step-2: Determine How Components are Disposed.....	4
Step-3: Identify Type and Quantity of Materials....	4
Step-4: Estimate Disposal Costs of Materials.....	5
Step-5: Summation of Material Disposal.....	6
CONCLUSION.....	6
LIMITATIONS.....	6
ADVANTAGES.....	7
RECOMMENDATIONS.....	8
BIBLIOGRAPHY.....	9

## ESTIMATING DISPOSAL COSTS USING THE COMPONENT MATERIAL METHODOLOGY

### INTRODUCTION

When buying a car, most consumers consider the total cost of owning the vehicle: purchase price, gasoline costs, repair bills, etc. As our society becomes more environmentally conscious, we may need to include the costs of disposing of the car as well. Most wreckers will pay you for your old car, but the price is going down. Wreckers are paying less due to increasing disposal costs for such items as tires, used oil, and freon refrigerant. Conceivably, you will need to consider the cost of getting rid of a vehicle when car shopping in the future. The concept of considering disposal costs when making a purchase is changing the way the Department of Defense (DoD) is doing business.

The DoD is currently modifying the 5000 series acquisition regulations to include a new phase to the acquisition life-cycle, *disposal and demilitarization* (1:-). This change requires the acquisition community to consider both disposal cost and its environmental impact as part of its overall acquisition strategy. As a result, life-cycle cost estimates must include disposal costs. Unfortunately, estimating disposal costs, especially in the early phases of the acquisition cycle, is extremely

difficult. Little data are available and few cost models exist for disposal estimating. This paper will discuss a working alternative for estimating weapon system disposal costs, the Component Material Estimating Methodology.

## **DISCUSSION**

### **METHODOLOGY CONCEPT**

The basic concept of the Component Material Methodology (CMM) is to estimate disposal costs based on the type of materials used in the weapon system. Rather than estimating an overall disposal cost for the system, the CMM estimates the disposal costs for each type of material used in the system. The methodology looks at the system's individual components (e.g., engines, landing gear, and avionics), determines the type and quantity of materials used in each component (e.g., aluminum, heavy metals, and composites), and estimates the cost of disposing of those materials. The individual material disposal costs are then summed for a total weapon systems disposal cost.

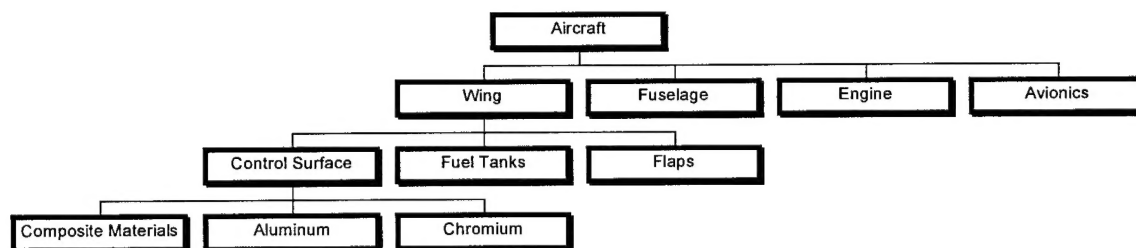
### **METHODOLOGY EXPLANATION**

The component material estimating process consists of five basic steps: (1) break down the weapon system to its component

parts, (2) determine how the components are disposed, (3) identify the types and amount materials in each component, (4) estimate the material disposal costs, and (5) sum the individual material disposal costs.

**Step 1 - Break down the weapon system into its components:**

A cost analyst will first breakdown a weapon system into its component (sub-system) elements. This breakdown typically follows the system's work breakdown structure (WBS). Figure 1 shows a simplified example of an aircraft WBS. The level of detail depends on the complexity of the system, how mature the program is, and available information. In addition, as discussed in step 2, the level of detail also depends on how each component is disposed. The ultimate goal of this step is to go far enough into the WBS to identify the materials that comprise each component.



**Figure 1 - Aircraft WBS**

**Step 2 - Determine how the components are disposed:** After breaking the weapon system down, the analyst determines how each component is disposed. This step is particularly important, because the DoD has been disposing of weapon systems for a long time and a great deal of data is already available. For example, the Air Force sells its used engines to foreign governments and commercial enterprises. The disposal costs, or benefit in this example, is the salvage value of selling the engine. The analyst does not need to estimate below this level, typically level 2 or 3 of the WBS. The material composition of the engine is not important since the analyst knows the disposal method and cost. On the other hand, the wing structure of an airplane has several different components, composed of numerous materials. The analyst will need to break down the wing to lower levels and then go to step 3 to determine the type and quantities of materials used.

**Step 3 - Identify the types and amounts of materials in each component:** After breaking the system down to its component levels, the analyst determines the type and quantity of material in each component. This information is available from several different sources. The Program Office or supporting depot(s) has the material weight specifications for weapon systems in



production or currently fielded. These specifications provide the type and quantity of materials used in each component. For weapon systems which are not fully developed, estimates of the type and amount of materials used can be built from similar systems. These estimates should consider the total weight of the weapon systems, the distribution of weight between components, types of materials used in previous systems, etc. These estimates require in-depth research and must account for changes in the manufacturing process. However, approximations on the materials and quantities can be made.

**Step 4 - Estimate the disposal costs for each material:**

Once the type and amount of materials used are known, analysts can calculate the disposal costs. The disposal cost for most materials is already available through the Defense Management Reutilization Service (DMRS).<sup>1</sup> DMRS contracts for disposing or recycling of most materials, including hazardous materials. Determining the disposal costs for these materials is just a matter of multiplying the amount of material by the disposal cost per unit. For example, if disposal costs for a composite material is \$12 per pound and the flaps of an aircraft contain 500 pounds of composite, then the disposal costs for the

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<sup>1</sup> Defense Management Reutilization Office (DMRO) at the base or depot level.

composite material is \$6000.

$$\$12/\text{lb} * 500 \text{ lbs} = \$6000$$

Disposal costs for other materials used in the flaps are calculated and summed as demonstrated in figure 2.

**Step 5 - Summation of material disposal:** Once the analyst estimates the disposal costs for the individual items, the costs can be summed for a total system disposal cost. Figure 2 below shows an example of this summation. The disposal costs are now available for each component, material type, or the total system.<sup>2</sup>

	Composite	Aluminum	Chromium	Total
Wing				
Control Surfaces	\$20,400	(\$700)	\$4,500	\$24,200
Flaps	\$6,000	(\$200)	\$0	\$5,800
Fuselage	\$60,000	(\$2,500)	\$6,500	\$64,000
Avionics	\$0	\$0	\$5,000	\$5,000
Total	\$86,400	(\$3,400)	\$16,000	\$99,000

**Figure 2 - Material Disposal Costs**

## CONCLUSION

### LIMITATIONS

The CMM is a simple approach to a very complex problem, and several limitations should be considered. First, the methodology

<sup>2</sup> The aluminum costs are negative (in parenthesis) since the government is selling this material as scrap and will get a return.

ignores the labor and overhead costs associated with disposing of a system. Labor and overhead costs are often included in the base or depot rates, but identifying these costs is very difficult. Second, some weapon systems cannot be broken down to their component parts. The complexity of the system does not allow for easy segregation of component materials. Third, classification of materials can change, especially for hazardous materials. For example, metals and plastics which come in contact with hazardous materials are classified and disposed of as hazardous materials. Although CMM has limitations, it also has several important advantages.

#### **ADVANTAGES**

First, the estimate can be done with little "environmental" experience. The estimator does not need specific details on how DMRS disposes or salvages different material, only the cost for doing so. Second, this type of estimate can be performed with a simple spreadsheet or with a more sophisticated cost model. Third, CMM provides flexibility, because the analyst is not restricted to a certain level of detail. If the weapon system is at a Milestone I or II decision point, the analyst can estimate disposal costs at a very high level of detail based on analogies

to similar systems. As the program progresses and more data is available, the analyst can go to lower levels of detail in the WBS and estimate more precisely. Finally, CMM provides the ground work for further model development. As data is collected, cost estimating relationships between weapon systems and disposal costs can be developed for use in more sophisticated cost models.

#### **RECOMMENDATIONS**

1. The Air Force Cost Analysis Agency, the Army Cost and Economic Analysis Center, and the Navy Center for Cost Analysis should use this methodology for estimating disposal costs if no applicable models are available.

2. Profits estimated from recycling materials or selling components should be considered a zero gain to the government. This methodology is not precise and assumptions about return on investment would be inappropriate.

3. Analysts should be aware that the DoD has been disposing of weapon systems for a long time. Disposal costs for many systems are already within the base and depot rate. The issue is to ensure that life-cycle cost estimates include all applicable costs, not to develop a "disposal number."

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